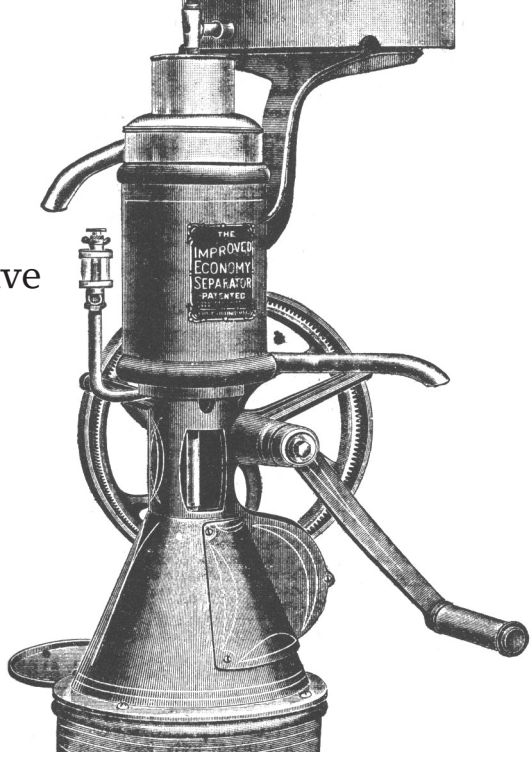
'If men have the talent to invent new machines that put men out of work, they have the talent to put those men back to work.' **Chris Pissarides** investigates whether President Kennedy's claim is still true.



Is new technology good or bad for jobs?

Governments throughout the world strive for technological progress. Economists agree that differences in technological attainment are the main cause of differences in incomes and wealth across the world. So is it not odd that we should even be raising the question of how good new technology is for jobs? If it is not good for jobs, what is it good for? How can new technology achieve so many good things if it is bad for jobs?

But odd as it may seem, the question is being asked whenever there is talk of new technology. Adverse comment takes different forms. Sometimes it is in connection with the romanticised machine-breaking of the Luddites of early nineteenth century Britain, the skilled workers who lost their jobs to machines. More frequently, it is in connection with a more boring comparison of statistics across nations.

In the 1990s, new technology was making American labour more productive, employment was rising and unemployment was falling to levels that seemed to defy analysis. Europe's productivity gains were smaller but its labour market performance was even worse. Talk of Europe's 'jobless recovery' became the vogue (though currently, it is the United States that is going through a jobless recovery, as explained by Richard Freeman and William Rodgers in the last issue of *Centrepiece*).

Why might new technology be bad for jobs, despite its many other good things, and what is in the numbers? Recent work I have done at the CEP in collaboration with Giovanna Vallanti and Sandra Bulli sheds light on this question.

Ironically, it is sometimes easier for the layperson to come up with reasons why new technology may be bad for jobs than it is for the trained economist. The layperson will almost certainly think of the Luddites' plight or the loss of manufacturing employment. If new technology invents machines that can do the job that workers are doing, then, the argument goes, it must be bad for jobs.

But the economist will point to the fact that new technology makes jobs more productive. More productivity means more wealth and more wealthy individuals spend more. So new jobs are needed to satisfy their new needs. As John F Kennedy put it, 'if men have the talent to invent new machines that put men out of work, they have the talent to put those men back to work.' The key is that those men need to get back to work to produce the extra goods that a wealthier society requires.

Of course, new technology is not always of the kind that puts men out of work. I am writing this article on a machine that weighs three kilos. It cost my employer less than a week of my wages and does an incredible number of things, much more than I could ever do with my hands and my secretary's typewriter before this machine was invented. Yet neither my secretary nor I lost our jobs. We both learned how to work with the new technology and this has made us more productive.

True, some workers do lose their jobs

The labour market of modern societies is in a continuous state of flux and one key reason is new technology

when new technology is invented. Not as many workers now stand along an assembly line as in 1936, when Charlie Chaplin immortalised it in *Modern Times*. But then not as many workers sat behind desks in 1936 as in 1987, when Tom Wolfe wrote *The Bonfire of the Vanities*. The internet has made many airline ticket sellers in high streets redundant, but it has opened up demand for programmers, despatch workers and online payment administrators.

New technology replaces the old with the new; it brings change to the labour market. Some jobs become more productive, some jobs become obsolete and some new types of jobs are born. The labour market of modern societies is in a continuous state of flux and one key reason is new technology. New fashions, demographics and natural phenomena also contribute to change. But the main reason for the big changes in the labour market – the decline of agricultural employment, the rise and then decline of heavy industrial employment, the rise of the office worker – is technological change.

This change is good for jobs overall because it makes the average job more productive. But the question of employment remains: is it also good for the volume of employment or is a society undergoing faster technological change than another necessarily operating at a lower level of employment than another?

The answer to that question is in the numbers. Our theoretical work notes that there are different kinds of technology and some are good for jobs and some bad. If a large fraction of technology is of the kind that makes jobs obsolete, the workers who lose their jobs will need to be re-employed elsewhere. Although demand for new jobs will increase in response to the rising wealth accompanying the new technology, job creation and the matching of the displaced workers with the new jobs takes time.

An economy undergoing fast technological change needs to be continually reallocating workers from the industries that introduce labour-saving technology to new industries, and the result is likely to be higher transitional unemployment. But if technology is primarily of the kind that increases the productivity of workers at their place of employment, like the introduction of computers in offices, people are more likely to hold on to their jobs and employment will on average be higher.

Our work uses statistical information from the United States, Japan and most countries in the European Union to identify the kinds of technology that have hit labour markets in the last 30 years. We find surprising results. Virtually all technology is of the kind that is good both for productivity and jobs. We find no evidence of massive job destruction at the level of the economy as a whole as a result of the introduction of new technology.

Even if some sectors of the economy are adversely affected by new technology, these adverse effects do not have an impact on the aggregate economy. In the last 30 years, both aggregate productivity and aggregate employment benefited greatly from the introduction of new technology. Modern-day Luddites undoubtedly get hurt because they lose their jobs, but JFK got it essentially right: most jobs benefit from new technology and the few that do not are replaced by others with no negative impact on the volume of overall employment.

Let me give some examples of the importance of new technology for jobs. In the United States in the decade before

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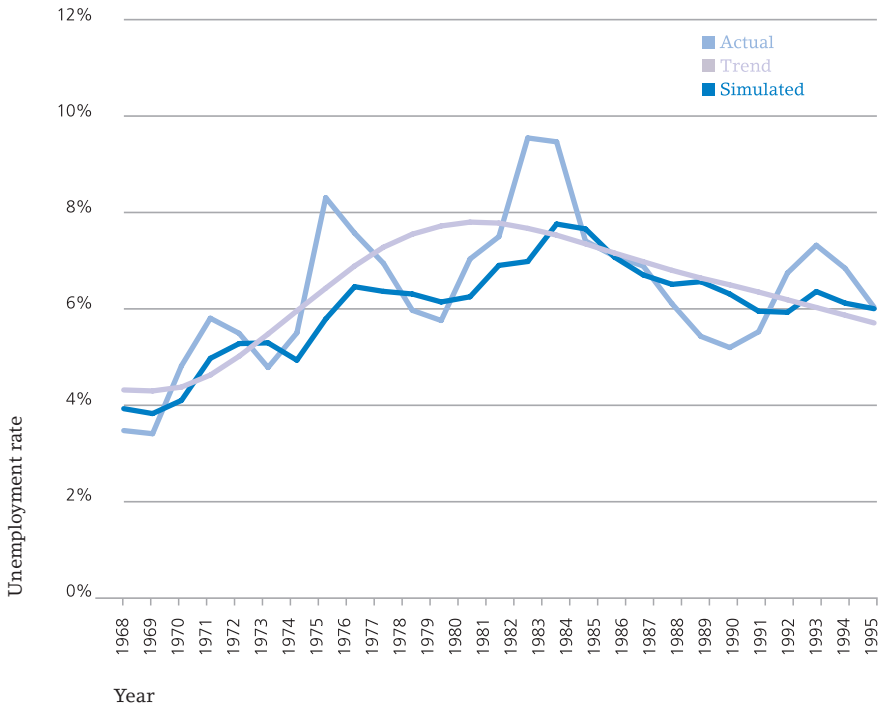
1973, 'total factor productivity' or TFP – the measure of how efficiently inputs of capital and labour are used – was growing at about 1.9% a year. In the 20 years that followed, TFP growth dropped to an annual average rate of 0.8%. We estimate that this drop was responsible for virtually the entire rise in unemployment from about 5% to 6.8% of the labour force.

In a similar vein, in Europe, productivity growth dropped from nearly 4% to 1.8% a year while unemployment went up from 2.3% to 6.6% of the labour force. Our estimates show that just over three percentage points of this 4.3 percentage points rise were due to the productivity slowdown. This pattern is repeated throughout the last 30 years.

Figure 1 shows three series for unemployment in the United States: actual unemployment; the unemployment trend; and the series that would be generated if

Figure 1:
Unemployment rates in the United States 1968-95



productivity growth were the only influence on unemployment. It is clear that our simulated series tracks the trend changes in unemployment quite well. It misses out the short-term fluctuations that are due to the business cycle and government policy, which is not surprising. But the influence of new technology on jobs seems to be sufficiently strong to track virtually all the underlying trends in unemployment.

This close correlation is not repeated in Europe, but new technology still matters and is still good for jobs. Figure 2 shows the unemployment rate in Europe versus our productivity-predicted rate. A lot more seems to be influencing the underlying trends in unemployment than new technology. The economics literature has explored the role of labour market policies and institutional rigidities and much has been written about them in *Centrepiece* (see page 23 of this issue) and elsewhere.

Productivity growth is still an important influence on jobs, but in Europe we have to face the fact that a recovery of productivity growth alone will not be able to create enough new employment to offset the rise in unemployment of the previous two decades. Institutional reform is also necessary.

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THE IMPROVED ECONOMY SEPARATORS FOR 1907 resemble in general appearance our 1906 model, which carried the country by storm last year, sweeping away all competition and which was acknowledged by all fair minded and competent judges to be the closest skimming and most practical farm cream separator ever devised. Our 1907 pattern possesses all the great improvements and exclusive features that made our 1906 machine famous. It has by far the closest skimming device ever invented. It is the easiest running, most durable and the nearest to a self cleaning and flushing separator ever made. In our 1907 pattern we have by the expenditure of hundreds of thousands of dollars for improved machinery, much of it designed exclusively for our use, and not to be had by other makers, by employing the very best talent in every department, by a rigid system of inspection by which every machine is scrutinized and tested at each stage of its construction, attained a mechanical perfection which is at once the wonder and envy of all other makers. Our 1906 Economy was the closest skimming separator ever offered, yet our 1907 model will skim closer.

OUR 1906 ECONOMY WAS THE SIMPLEST, EASIEST RUNNING, EASIEST CLEANED AND MOST PRACTICAL CREAM SEPARATOR EVER OFFERED, BUT OUR 1907 PATTERN RUNS STILL EASIER, CLEANS STILL EASIER AND IS STILL MORE PRACTICAL.

IN THE 1907 ECONOMY we have improved the oil cup, improved the composition of the high speed bushings, improved the construction of the bowl, simplified the adjustment of the cream screw, changed and improved the supply tank and its fastening, the milk cover and spout, the crank ratchet, the method of casting the frame, and in many other points have benefited by the experience of our customers and ourselves. As our 1906 Economy was the acme of separator construction last year, so our 1907 model this year excels all others.

OTHER MANUFACTURERS attracted by the wonderful success of the Economy are falling into line, other machines are being produced which in general outline at least, approach the Economy, that resemble it in outward appearance, but they one and all lack the vital point, the wonderfully effective skimming device of the Improved Economy, which is covered by strong basic patents and cannot be obtained in any other cream separator sold by any other maker.

THANKS TO THE MORE THAN LIBERAL PATRONAGE of the shrewd and careful farmers throughout the country the growth of our separator business has been almost beyond belief, really the marvel of the separator world. We are now by far the largest makers of hand cream separators in the world. Our great Economy factory, in Central Iowa, with its wonderful mechanical equipment, its great expert organization, its unrivaled facilities for the transformation of raw material to the finest separator in the world, now produces 300 complete Economy Separators every working day in the year, more than two carloads, more than twice as many as the next largest maker.

THIS WONDERFUL BUSINESS has been built up first by the genuine merit of the Economy, and then by the good will and the good words of our more than satisfied customers. Every Economy Separator we have sent out has sold others, single machines have led to our supplying whole communities. The story of its wonderful merit, quickly appreciated by our customers, has spread from mouth to mouth, from farm to farm in ever widening circles, leaped from neighborhood to neighborhood, from community to community. From far and wide orders have poured in upon us, our sales have been limited only by the capacity of our factory. While we have increased our output as fast as machinery could be made and installed, the demand has always exceeded the supply.

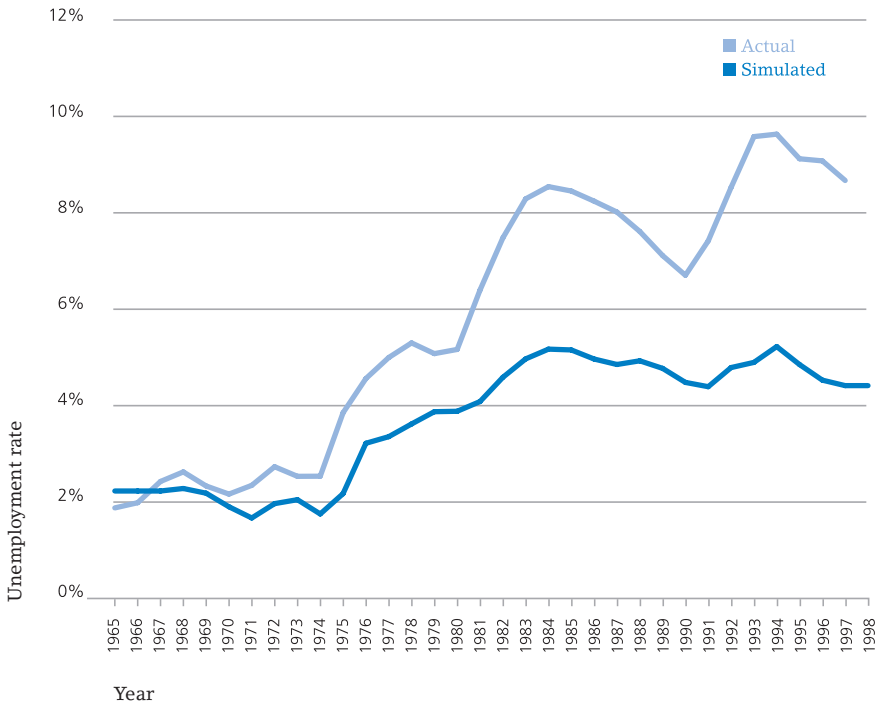
FOLLOWING OUR FIXED AND ALWAYS UNCHANGED POLICY of selling on a single small margin of profit and of giving our customers the benefit of every penny we can save in manufacturing cost, by reason of increased output and improved methods and machinery, we have steadily reduced the selling price of the Improved Economy from year to year until we can now offer our great 1907 Jumbo Economy, the most perfect hand cream separator ever built; the big 750 pounds per hour size, at the wonderfully low price of $33.95. Three years ago we were obliged to ask $106.25 for our old style Economy of the 500-pound size which, although equal to most of the separators sold by other manufacturers today, can in no way be compared with the "improved Economy for 1907. Each year we have, by reason of our increased output, by the installation of many thousands of dollars worth of improved machinery, by the introduction of the latest improved methods in manufacturing, reduced the manufacturing cost, and each year we have made a corresponding reduction in our price to our customers, giving them the benefit of every penny we have saved in the cost. Feeling that their liberal patronage has enabled us to reduce the cost and that they are, therefore, entitled to all that has been thus saved, we cannot justly do otherwise.

TO BRING ABOUT this great reduction in price, amounting to $72.30 on the large 750-pound size and proportionately as great on the smaller sizes, we have left no stone unturned, no deed undone that would improve our manufacturing facilities. We have installed hundreds of thousands of dollars worth of the highest type of automatic and labor saving machinery. We now have five times as many automatic machines as any other maker. We make every bolt, screw and nut used in our separators. Other manufacturers buy these. We draw our own bowls and supply tanks in a huge press, weighing 37,000 pounds; all other makers buy these parts ready made from other concerns. Not only do we make these and many other parts which no other separator manufacturer has attempted to make, but we make our own tools, gauges, drawing and stamping dies. Our various manufacturing departments are in charge of picked experts, many of them having a national reputation in their line. Our general superintendent, Mr. M. A. Ganiard, was formerly superintendent of the DeLaval Separator Co.'s shops at Poughkeepsie, N. Y.; Mr. A. E. Jackson, manager of our lathe and automatic tool department, was formerly assistant superintendent for the same concern. Mr. J. G. Jones, manager of our die making, drawing and sheet metal departments, has a national reputation as an author and lecturer in these lines, and his treatises on metal drawing and stamping are the standard authority everywhere. Our tool and gauge making room is in charge of Mr. Edward Shieldrick, formerly with Fairbanks, Morse & Co., of Beloit, Wis. Thus in these and in all other departments, our expert help, our improved machinery and appliances, our painstaking inspection and tests insure to the Improved Economy purchaser a machine that in mechanical construction and effectiveness is without an equal and at a cost that is less than one-half the price asked by other makers.

OUR GREAT CHALLENGE OFFER of $1,000.00 in gold to the separator manufacturer who could produce a machine that would outskim the Improved Economy at 50, 60, 70, 80 and 90 degrees, made last year, still stands unclaimed. Although advertised far and wide, no maker has dared to come forth and accept our challenge. The Improved Economy is still the closest skimmer in the world at all temperatures and under all conditions.

THE TERMS OF THE FREE TRIAL OFFER to purchasers of the Improved Economy have this year been extended from thirty days to sixty days in order to give our customers not only ample time to become thoroughly familiar with the operation of the machine, but also to find out from their own experience what a big money saver it is, how much more butter it will enable you to make from any quantity of milk, how much better the butter is, and what a work saver, time saver and money maker the Improved Economy really is for every dairyman. You have sixty days in which to try our Improved Economy Separator and to put it to any test you may wish, and if at the end of that time you are not fully satisfied with it in every way, you are at liberty to return it to us and we will at once return all the money you have paid us, and also pay all the transportation charges both ways, so that you cannot lose a penny. This is the fairest and most liberal offer ever made by any separator maker, and is possible for the reason that our experience has proven that no other separator in any way compares with the Improved Economy.

Figure 2:
Unemployment rates in the European Union 1965-98



On its own, a recovery of productivity growth in Europe will not create enough new employment to offset the rise in unemployment

Christopher Pissarides is Professor of Economics at the London School of Economics and director of CEP's research programme on macroeconomics. More details on the research discussed here are in 'Productivity Growth and Employment: Theory and Panel Estimates', CEP Discussion Paper No. 663, by Christopher A Pissarides and Giovanna Vallanti (http://cep.lse.ac.uk/pubs/download/dp0663.pdf).